Diagnosis and Treatment of Cataracts and Lens Instability

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CATARACTS

A. Definition: Any opacity of the lens

B. Causes of cataracts in dogs:
   1. Inherited is the most common cause
   2. Diabetes mellitus – as glucose levels increase in the eye with diabetes, hexokinase becomes saturated, glucose accumulates in the lens and begins to be metabolized by the sorbitol pathway, sorbitol and fructose accumulate within the lens cells resulting in a hypertonic state which causes water to accumulate, the lens fibers continue to swell and rupture forming vacuoles in the lens cortices and eventually the entire lens becomes opaque.
   3. Nutritional disorders
      a. Arginine or other amino acid deficiencies
      b. Xylose excess: rats
      c. Galactosemia: kangaroos, wallabies fed cow’s milk
   4. Progressive Retinal Atrophy (PRA) – dialdehyde toxins are released from the degenerating retina causing subcapsular and cortical lens opacities
   5. Electrolyte/mineral imbalances: hypocalcemia
   6. Trauma
   7. Inflammation (uveitis) = especially cats and horses
   8. Electric cord shock
   9. Irradiation (radiation therapy for cancer)
   10. Toxins or drugs – corticosteroids in humans, disphenol (DNP), naphthalene in dogs, hygromycin in sows; DMSO: transient
   11. Senility – may refer to time of onset and etiology (not nuclear sclerosis)
   12. Persistent vascular remnants

C. Classification of cataracts
   1. By age of onset (does not imply etiology)
      a. congenital: present at birth
      b. juvenile: few months to 6 years
      c. senile: dog >6 years
   2. By location (determined by slit lamp)
      a. capsular
      b. subcapsular (anterior, posterior, equatorial)
      c. cortical
      d. nuclear
      e. axial
      f. polar
      g. equatorial
   3. By degree of maturation
A. Incipient (less than 10% of tapetal reflection obstructed)
b. Early Immature (10 to 50% of tapetal reflection/fundic view obstructed)
c. Late Immature (51 to 99% of tapetal reflection/fundic view obstructed)
d. Mature (100% of tapetal reflection/fundic view obstructed)
e. Hypermature (cortical lens material may undergo liquefaction and part of the tapetal reflex may be seen; the lens capsule may be wrinkled with multifocal dense white plaques, the anterior chamber depth may be increased, may see signs of lens-induced uveitis) - refer before this stage to increase success of the surgery

D. Likelihood of progression
1. nuclear: usually static
2. cortical: variable, often progressive
   a) anterior cortical – more likely progressive
   b) posterior cortical
      1. axial, well-demarcated – unlikely to progress
      2. peripheral/vacuoles – likely to progress
   c) equatorial: often progressive

E. Sequelae to cataracts
1. These dogs should not be used in a breeding program
   a. If selling animal, the buyer must be told!
2. The dog may lose vision (depends on likelihood of progression)
3. Chronic or hypermature cataracts will develop lens-induced uveitis, may develop secondary glaucoma and/or retinal detachment
4. Diabetic cataracts may result in severe lens-induced uveitis
5. Diabetic cataracts that progress rapidly may result in spontaneous rupture of the lens capsule due to massive lens fiber swelling.

F. Lens-induced uveitis
1. Immune-mediated intraocular inflammation caused by liquefaction and leakage of lens proteins from the lens capsule
   a) Most commonly occurs with rapid cataract progression, especially in diabetic dogs and young dogs.
   b) Cataracts do not need to be mature/hypermature in order to see uveitis.
2. Clinical signs: photophobia, blepharospasm, hyperemia, miosis, resistance of the pupil to dilate with tropicamide or atropine, aqueous flare, corneal edema
3. Treatment:
   a) Atropine 1% ophthalmic solution or ointment
      1. Contraindicated if intraocular pressure is elevated!!
      2. Use topically q 12-72 hours
      3. Stabilizes blood aqueous barrier, eliminates photophobia, prevents posterior synechia and seclusion of the pupil
   b) Prednisolone acetate 1% (Econopred Plus or Pred Forte or generic)
      1. Contraindicated with presence of corneal ulceration!!
      2. Use topically 2-4 times daily initially then gradually wean to once daily or every other day.
      3. May cause insulin resistance in diabetic dogs at high dosages
c) **Diclofenac 0.1% (Voltaren or generic)**
   1. Non-steroidal anti-inflammatory
   2. Not as potent as topical prednisolone
   3. Use topically 2-4 times daily initially then wean to once daily
   4. Does not affect insulin requirement of diabetic; therefore a good maintenance drug after uveitis is well-controlled

d) **Carprofen (Rimadyl)**
   1. Non-steroidal anti-inflammatory
   2. Works well in conjunction with topical medications
   3. 0.5 mg/kg PO q 12-24 hours

e) **Refer ASAP for evaluation of cataracts for surgery.**

### G. Surgical treatment of cataracts

1. Rule out diabetes mellitus
2. There is **no** medical therapy for cataracts!
   a. N-acetyl-cysteine products do **not** work!!
3. Surgery is the treatment of choice
4. Surgical success rates: best outcome (>90% success) if the cataract is immature-mature, success decreases to <85% if cataract is hypermature

### H. Surgical techniques:

1. **Phacoemulsification**
   a. Ultrasonic fragmentation of the lens
   b. Intraocular lens prosthesis placement
      i. Silicone foldable IOL with squared edges
         1. Best inhibition of lens epithelial cell migration and capsule fibrosis
         2. Larger surface area therefore less likely to decenter
         3. Decreased corneal incision length from approx 8 mm to approx 4 mm
            a. Less astigmatism & shorter closure time
   c. Two-handed technique – using a second instrument to shorten surgical time in hard lenses or improve stability of subluxated lenses
   d. Capsule tension ring
      1. PMMA ring designed to keep capsule taut to decrease capsule scarring
      ii. Also useful for improving stability of subluxated lenses
   e. If the cataractous lens is subluxated, phacoemulsification can sometimes still be done, but intracapsular lens extraction (ICLE) may be required.
   f. If the cataractous lens is luxated, it will require intracapsular lens extraction (ICLE) and a sulcus-fixated intraocular lens prosthesis can be sutured into the posterior chamber (behind the iris) – see Lens Luxations below.
There is currently no laser treatment for canine cataracts!!! ND:YAG laser is used often in human patients for posterior lens capsule scarring ("secondary cataract")

LENS SUBLUXATION AND LUXATION

A. Etiology (all involve degeneration or damage to the ciliary zonules)
   1. Primary/inherited – most terrier breeds
   2. Secondary to glaucoma (buphthalmia causes the zonules to break)
   3. Secondary to chronic uveitis (especially in cats)
   4. Associated with hypermature cataracts
   5. Trauma (uncommon)

B. Clinical Signs
   1. Aphakic crescent (a portion of the pupil is devoid of the lens)
   2. Iridodonesis and phacodonesis (quivering of the iris and lens, respectively)
   3. Deep anterior chamber if lens is posteriorly displaced
   4. Shallow anterior chamber if lens is anteriorly displaced
   5. Blepharospasm, corneal edema and increased intraocular pressure especially if anterior lens luxation; usually acute
   6. Complications of lens luxation: corneal endothelial damage (corneal edema, usually focal ventral paraxial), glaucoma, anterior uveitis

C. Treatment of lens luxation
   1. Surgical intervention: intracapsular lens extraction (ICLE)
      a. This is a surgical emergency if the lens is anteriorly luxated
      b. Even a posterior luxation may require removal because leaving the loose lens may predispose the eye to chronic uveitis, glaucoma and retinal detachment
      c. Prognosis is dependent on the cause, duration of the luxation and extent of secondary damage and presence of secondary glaucoma.
   2. Medical management with miotic agent
      a. Latanoprost (Xalatan) or travaprost (Travatan) q 12 hours
      b. Induces extreme miosis to keep lens posterior
      c. Antiglaucoma: increases uveoscleral aqueous outflow to lower IOP
      d. May be useful for contralateral subluxated eye after unilateral luxation
   3. No clinical study has been performed to date comparing the long-term retention of vision and maintenance of IOP after ICLE vs. latanoprost or travaprost
   4. Current treatment of luxation or subluxation is ICLE + endolaser of ciliary processes

NUCLEAR SCLEROSIS

A. Aging change due to compression of nucleus by cortical fibers
B. Age of onset:
   1. dog: 6 years
   2. cat: 7-9 years
   3. horse: 12-15 years
C. Diagnosis is made by dilating the pupil and seeing the fundic reflex
D. Treatment of nuclear sclerosis: none
E. If cloudiness progresses to the point where the dog is blind and the fundic reflex is not visualized, then senile cataract has developed and may require surgical treatment.